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Master Data File from the Summer 1975 Northeast Oxidant Transport Study User's Manual

Stanford Research Inst, Menlo Park, Calif

Prepared for

Environmental Protection Agency, Boston, Mass Air Branch

Jun 77

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USERS MANUAL

June 1977

MASTER DATA FILE FROM THE SUMMER 1975 NORTHEAST OXIDANT TRANSPORT STUDY

By:

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Prepared for:

ENVIRONMENTAL PROTECTION AGENCY
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The data from the EPA/Region I Summer 1975 Northeast Oxidant Transport Study have been collected, validated and compiled by SRI. The final product is a comprehensive data base for the study, stored on a single reel of magnetic tape. The manual describes the content and format of this magnetic tape. Both air quality and meteorological data, from ground stations and aircraft, are included for the study, which began on July 15 and ended on August 31, 1975. Four aircraft covered different geographical areas throughout the Northeast. The aircraft were operated by the Battelle Columbus Laboratories, Washington State University, the Interstate Sanitation Commission, and EAP (Las Vegas). Ground station data are included for Massachusetts, New York, New Jersey, Connecticut and Rhode Island.

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ABSTRACT

The data from the EPA/Region I Summer 1975 Northeast Oxidant Transport Study have been collected, validated, and compiled by SRI. The final product is a comprehensive data base for the study, stored on a single reel of magnetic tape. The manual describes the content and format of this magnetic tape. Both air quality and meteorological data, from ground stations and aircraft, are included for the study, which began on July 15 and ended on August 31, 1975. Four aircraft covered different geographical areas throughout the Northeast. The aircraft were operated by Battelle Columbus Laboratories, Washington State University, the Interstate Sanitation Commission, and EPA (Las Vegas). Ground station data are included for Massachusetts, New York, New Jersey, Connecticut, and Rhode Island. Detailed hydrocarbon analyses for samples collected aloft and on the ground were conducted by Washington State University and EPA (Research Triangle Park) and are reported in the master file. Upper air data (rawinsondes, pibals, and the Albany ozonesonde) are also reported for the study period.

I INTRODUCTION

A Transportation Control Plan for the attainment of primary standards for photochemical oxidants has been promulgated in Boston. Similar plans are being developed for Rhode Island, portions of Connecticut, and the Springfield, Massachusetts area. However, these plans only require control of photochemical oxidant precursor emissions with the respective air quality control regions.

Research and data on ambient air quality gathered in the past few years have indicated that the photochemical oxidant problem is not limited to urbanized areas nor even to air quality control regions. An EPA report, "Control of Photochemical Oxidants: Technical Basis and Implications of Recent Findings," published July 15, 1975 by the Office of Air Quality Planning and Standards, discusses some of these findings. Most of the research concerning photochemical oxidants has been conducted on the West Coast, in the Midwest, and in the mid-Atlantic states. However, during the summer of 1975 a study was conducted in the Northeast, including the New England area. Preliminary results were reported at a symposium held at Research Triangle Park, North Carolina, on January 20-21, 1976 (Bufalini and Lonneman, 1977). Several organizations participated in these studies and SRI, under contract to EPA (Region I), compiled and integrated the resulting data into a single, comprehensive master file. In addition to this study, SRI has analyzed the data to determine the sources (procursors) of the observed oxidants (Ludwig and Shelar, 1977).

A brief description of the data collected in the Northeast Oxidant Study appears in Section II. The structure and format of the master file are presented in Section III. Section IV details the content of a raw data file. This raw file includes those data deemed not appropriate for storage in the master file.

II SUMMARY OF MASTER FILE DATA

On 15 July 1975, a comprehensive field program was conducted in the northeast with a focus in the New England area. The primary objectives of the program were to monitor ozone (oxidant),* ozone precursors, and meteorological parameters throughout the area of interest. The resulting data provide a basis for analysis to determine the origins of ozone levels in Boston and other parts of the New England area.

The field study involved research teams from Battelle Columbus Laboratories, Washington State University (WSU), the Interstate Sanitation Commission (ISC), The Research Corporation of New England (TRC), and EPA groups from Research Triangle Park (RTP), Las Vegas (LV), and Region I. In addition, supporting data are available from several agencies. These data include:

- Air quality data from stations operated by agencies reporting to the EPA SAROAD data base.
- Upper-air wind measurements available through NOAA for calculation of trajectories.
- Standard weather data as collected by the National Weather Service (NWS); these are reported and stored at the National Climatic Center (NCC) in Asheville, N.C.
- Emissions data collected by state and local agencies; most of these data are eventually reported to the EPA NEDS data base.
- Ozonesondes taken at the Albany (New York) airport; some six valid soundings during the study period were collected by Research Triangle Institute (RTI).
- Aircraft data collected by RTI in late July as RTI tracked a high-pressure system from the midwest to the Atlantic

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*In this text the terms ozone and oxidant are used interchangeably.

On the basis of manageability, economy, and relevance, only portions of the above data could be included in the master file. However, all data are available on request from the appropriate agencies.

Intensive field data acquisition operations approximately span the period from July 15 through August 31, although all parties were not active the entire period. Three groups (EPA, WSU, and Battelle) operated both aircraft and ground stations. Locations of these ground stations and bases of operations are illustrated in Figure 1. The WSU unit was located on the southern Connecticut coast near Groton and Battelle operated out of Simsbury, Connecticut (about 25 km northwest of Hartford). EPA had two groups operating out of the Boston area. The Environmental Monitoring and Support Laboratory - Las Vegas was responsible for aircraft operations; the Environmental Sciences Research Laboratory operated the ground station and conducted extensive bag sample analyses.

At the ground stations, real-time instruments for commonly monitored pollutants (ozone, carbon monoxide, nitrogen oxides, and so forth) and for meteorological parameters were operated continuously. In addition, bag samples were taken at various locations, both on the ground and aloft. Subsequent analysis led to detailed breakdowns of various hydrocarbon compounds, freon-11, carbon tetrachloride, and PAN.

The Interstate Sanitation Commission (ISC) joined EPA, WSU, and Battelle in the aircraft monitoring program. Vertical and horizontal profiles of ozone and temperature were the primary data gathered. There were a few other parameters measured by one or more aircraft. These included nitric oxide, scattering coefficient, relative humidity (or dew point), and cloud condensation nuclei. A cross reference index of flights, aircraft, dates and times appears as Table 1. A summary of aircraft coverage and prevailing weather conditions for each flight is presented in Appendix A.

During the research operations, WSU and TRC conducted pibal programs from four locations, two each in Connecticut and Massachusetts. TRC subsequently merged these data into a single magnetic tape file.

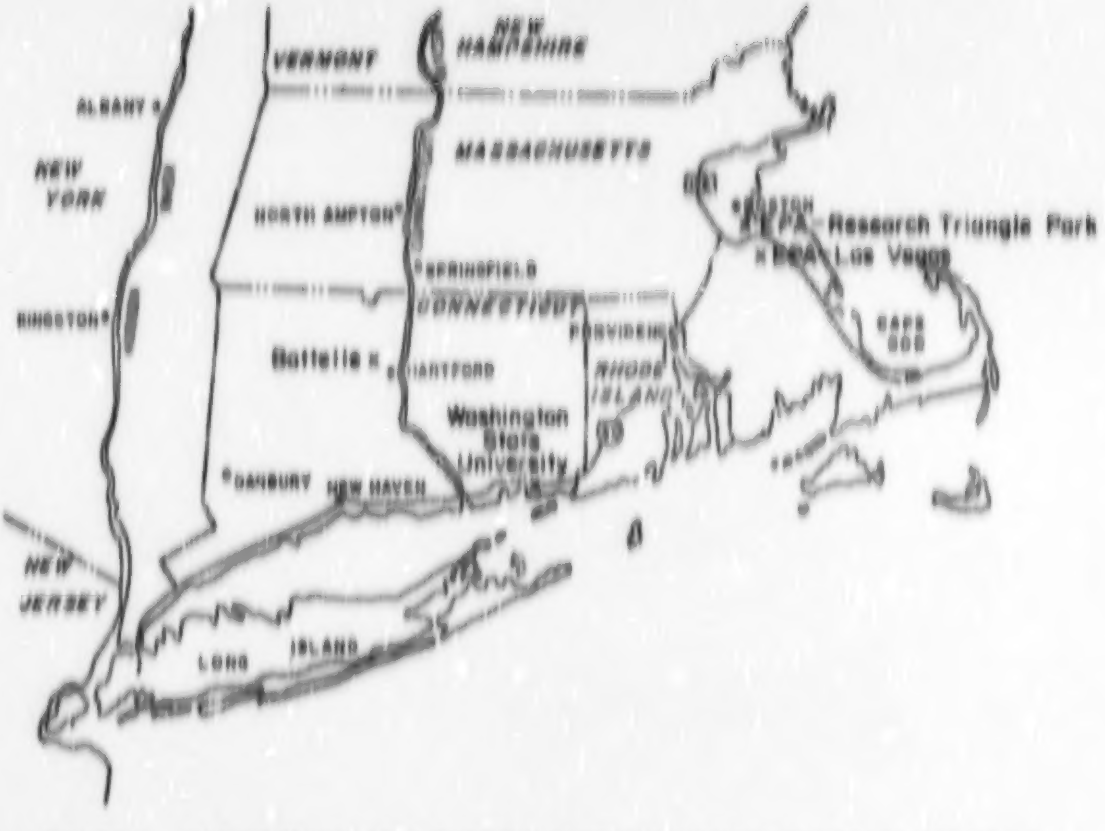
NEW HAMPSHIRE
VERMONT
ALBANY
NEW YORK
MASSACHUSETTS
NORTH AMPTON
BOSTON
EPA-Research Triangle Park
EPA-Las Vegas
SPRINGFIELD
KINGSTON
CONNECTICUT
PROVIDENCE
CAPE COD
Battelle
HARTFORD
RHODE ISLAND
Washington State University
DANBURY
NEW HAVEN
NEW JERSEY
LONG ISLAND

FIGURE 1 MAP OF STUDY AREA SHOWING BATTELLE, WASHINGTON STATE UNIVERSITY, AND EPA MOBILE LABORATORY LOCATIONS (COURTESY OF BATTELLE COLUMBUS LABORATORY)

Table 1 SUMMARY OF APPROXIMATE TIMES (EDT) OF AIRCRAFT OPERATIONS

	EPA, Las Vegas		WSU		ISC	Battelle	
Date	Flight Times	Vertical Sounding	Flight Times	Vertical Sounding	Flight[a] Times	Flight Times	Vertical Sounding
July							
15			16-17	16			
16			13-16	15			
18			16-17	16			
18						20-22	22
19			10-13	10,12			
19			16-19	17			
20						10-11	10
20			13-17	15,16			
20			19-20	20			
21			11-16	12,13,15			
21			16-18	16,17		17-20	18
22			8-9	8,9		9-11	
22			11-16	14,15		14-15	
23			8-11	9-10		9-12	11
23			15-17	16,17		14-17	16
24			9-12	10,12		9-12	
24			16-17	15		13-18	17
26			10-13	10,11		9-12	10,11
26			15-18	16,17		15-19	16,17
27			9-12	10,11		9-13	11,12
27			15-18	15,17		15-18	16,18
28			10-12	11		9-11	
28			16-17	15,17		16-17	
29			9-12	10,11		9-11	10,12
29			15-18	15,16		15-18	15,17
30			21-23	22,23			
31						15-17	
August							
2			12-15	13,15			
2			21-23	21,22,23			
3			10-13	11,12		12-15	
5						9-10	
5			13-15	13,14		11-13	13

---

[a] Vertical soundings were taken approximately hourly during Interstate Sanitation Commission Flights.

Table 1 SUMMARY OF APPROXIMATE TIMES (EDT) OF AIRCRAFT OPERATIONS (Cont.)

	EPA, Las Vegas		WSU		ISC	Battelle	
Date	Flight Times	Vertical Sounding	Flight Times	Vertical Sounding	Flight[a] Times	Flight Times	Vertical Sounding
August (Cont.)							
5						18-20	19-20
6			9-12	10,11,12		10-12	
6			14-17				
8			12-14	12,13		11-13	13
9	14-15		15-18	16,17		17-20	18
10			11-14	12,13,14	9-12		
10					9-12		
10					14-16	12-14	12,13
10			16-19	17,18	14-16	16-18	17-18
11	12-14	12,13,14	9-12	10,11,12	10-12	11-12	
12	10-11		9-13	12		10-12	11
12	13-16	14,15	15-17	16			
13	10-13	11,12,13	9-12	10,11		10-13	11,12,13
13	15-17	15,16,17	16-19	16,17,18		16-19	17-18
14	12-13	12,13	10-13	11,13		10-13	12,13
14	15-18	17	16-19	16,18		15-18	16,17
15					1-6		
15			10-13	11,12,13	11-16	10-13	11,12
15	15-18	16,17	17-19		12-17		
17	10-12	10,11,12					
18			11-14	11,13		9-10	
18						12-15	13,14
18			20-21	20		17-21	19
19	10-12	10,11,12	10-13	11,12	9-12		
19					10-13	10-13	
19	15-17	15	15-17	15,16	15-17	17-19	17,18
19			19-22	20,22	15-18		
20	9-12				10-13		
20	14-16		12-15		13-16	14-18	15,16,17,18
20			16-18		16-17		
21			9-12	11	9-12		
21					9-12	10-12	11
21			15-17	16,17	16-17	16-18	

---

[a] Vertical soundings were taken approximately hourly during Interstate Sanitation Commission Flights.

Table 1 SUMMARY OF APPROXIMATE TIMES (EDT) OF AIRCRAFT OPERATIONS (Concl.)

	EPA, Las Vegas		WSU		ISC	Battelle	
	Flight Times	Vertical Sounding	Flight Times	Vertical Sounding	Flight[a] Times	Flight Times	Vertical Sounding
August (Concl.)							
21					16-17		
26	10-12	10,11,12					
26	17-18						
27	10-12	11,12					
27	14-15						
27	16-17						
28	11-12						

[a] Vertical soundings were taken approximately hourly during Interstate Sanitation Commission Flights.

The preceding paragraphs summarized the general scope of the relevant data collected during the Northeast Oxidant Study. The nucleus of the data has been included in the master data file. The exact content and format of the master file are presented in Section III.

III MASTER FILE ORGANIZATION

A. Overview

The master file is stored on a single magnetic tape in formats and codes discussed later. Data in the master file have been condensed to a form appropriate for most analyses. Ground station data have been reduced to hourly averages; aircraft data have been reduced to vertical profiles and constant-level spatial averages covering 10 kilometer squares, and so forth.

To supplement the master file, a second data set containing all reported data points has been prepared. This "raw data file" (see Section IV) contains aircraft observations in engineering units used to derive the spatial averages described above. The raw data file also contains aircraft observations that could not be classified as vertical profile or constant level data. It is stored on the master file tape starting at the twelfth file.

As stated in Section II, not all relevant data could be incorporated into the master file. In general, all data collected by the special field study groups has been included. In addition, certain other relevant data have been included even though they are readily available from other agencies. The general content of the master file is summarized below.

B. General Master File Structure and Form

The master file is stored on a single reel of magnetic tape. The data are organized into eleven files, as illustrated in Table 2.* A detailed breakdown of each file is presented in Section III-C. The first record(s) in the files contain general information about the content, format, and codes in the ensuing data. These "header" records are self-documenting and facilitate use of the subsequent data file.

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*Tables and figures referred to in this section appear at the end of the section.

Data were supplied to SRI by the study participants in a variety of forms: tabulations, strip chart records, instrumentation tape, and computer processed magnetic tape. Data not already in computer-compatible form were reduced to punched cards or, in some cases, directly to magnetic tape. Subsequently, these data were validated and merged onto the master file at the SRI CDC 6400 computer center.

The master file was delivered to EPA and the National Technical Information Service (NTIS) in the following form:

- Computer-compatible magnetic tape, 2400 ft reel
- 9-tracks, 1600 bits per inch
- Extended binary coded decimal (EBCDIC)
- Blocking factor = 50.[*]

The final feature (blocking factor of 50) greatly increases the tape utilization efficiency at the expense of some processing time. However, the increase in processing time is far outweighed by the advantage of having the entire file on one magnetic tape.

Data have been statistically screened and validated. Invalid data were replaced with a -999.9 in the master file. Questionable data have been flagged with a "-" prefix while retaining their absolute value.

C. Format Descriptions by File

The content and format of each of the 11 files are described below in order of appearance on the master file.

---

[*] Corresponds to 50 card images (or 400 characters); one physical record contains 50 logical records.

File 1--Ground Ozone Data (SAROAD)

This file includes data for many stations in the Northeast normally reporting to the EPA SAROAD data base. Primarily, monitoring stations from Connecticut, Massachusetts, Rhode Island, New Jersey, and New York are included, along with a few stations from New Hampshire and Vermont. The order in which they appear on the tape is presented in Table 3.

Table 3 is a reproduction of the header records for File 1. The digit in the uppermost left-hand corner represents the number of physical records occupied by the header. The digit is contained in the first card image (I3 format). In this case, the digit "3" corresponds to 130 card images or lines. Hence, ozone data begin in the fourth physical record. The data covering each station for the 48-day period appear in contiguous logical records. It should be noted that a few stations have long periods of missing data. In these cases, space is not allocated in the file for the missing data.

Standard SAROAD format and codes are used through this file [refer to the SAROAD Users Manual (1971)]. Figure 2 is a reproduction of the card format used. Note that a record of hourly averages spanning one day requires two cards (12 hourly averages per card).

File 2--EPA Ground Station

The EPA mobile station operated continuously from 13 July through 28 August. The header occupies one physical record. Starting in the second physical record, ultraviolet radiation data appear in contiguous records for the 47-day period. This is followed by 47 days of contiguous ozone data and then other parameters in the order illustrated in Table 4. The SAROAD format is used throughout this file. SAROAD codes for all pertinent parameters, methods, and units are also tabulated in Table 4. A unit code of 00 corresponds to units not yet defined in the SAROAD system.

File 3--WSU Ground Station

The Washington State University ground station file is formatted in the same manner as File 2 above. The order and pertinent codes appear in Table 5. A parameter code of 90000 and above indicates a parameter undefined by the SAROAD system.

File 4--Battelle Ground Station

The Battelle ground station file, except for the order of data, has the same format as Files 2 and 3. The order and relevant codes appear in Table 6.

File 5--Ground Bag Sample Analysis

Because of the nonroutine nature in which bag samples were collected, a variety of formats are necessary to describe data contained in this file. Data are subdivided into a number of data sets (subfiles), each of which is preceded by a header* card. The general file structure is presented in Table 7. Header and data card formats and the associated codes are described in Table 8.

File 6--Horizontal Aircraft Data

Horizontal aircraft data included in this file correspond to spatial averages calculated during times when the aircraft's altitude was relatively constant (altitude variations of less than 500 feet). Table 9 illustrates the order of the data as they appear on the file. Formats and codes are summarized in Table 10. Spatial averages were calculated for 10 × 10 kilometer grids corresponding to integral UTM coordinates. In the file, the average is referenced to the lower lefthand (southwest) corner of the averaged grids. Since this coordinate is an integral of 10 kilometers (by definition) UTM coordinates can be simplified to two digits and three digits for X and Y, respectively. For those occasions where the flight path crossed through UTM zones, values are averaged for an irregular (wedge-shaped) grid at the zone boundary.

---

*Hereafter, headers occupying the first physical record(s) in a file are referred to as file headers. These are distinct from data set (or subfile) headers.

File 7--Aircraft Data, Vertical Profiles

During aircraft operations, spiral ascents or descents were conducted to collect vertical profiles of a number of parameters (primarily temperature and ozone). As was the case with File 6, these aircraft data are presented in contiguous records for each aircraft in the order presented in Table 11. The formats, codes, and units are described in Table 12.

File 8--Aircraft Bag Sample Analyses

Bag samples were collected at various times during most flights. These were later returned to the base station for detailed analysis, mainly for hydrocarbons. The file header for the aircraft bag-sample formats and codes is presented in Table 13. The EPA aircraft bag analyses are presented in contiguous records (Header 03) followed by the WSU analyses (Header 08). Analyses are presented in sequence by flight number.

File 9--Ozonesondes at Albany

Six ozonesondes measurements conducted at the Albany airport have been included in the master file. The corresponding formats and codes are presented in Table 14, the file header for File 8. Data for each sounding is preceded by a single header record.

File 10--Pibal Releases (Vertical Wind Profiles)

Pibal releases were conducted at four locations and are presented in the order shown in Table 15. Each release is documented in the file with two header records and a variable number of data records. The first header record contains information on the date and time of release; the second documents the location. The ensuing data cards contain the reduced pibal information (elevation, wind components, wind direction, and wind speed) as per the file header shown in Table 15. This file header occupies the first physical record.

File 11--Rawinsondes, Vertical Temperature and Wind Profiles

Rawinsondes are reported for four locations in the area. The file header record (Table 16) describes the format and units used.

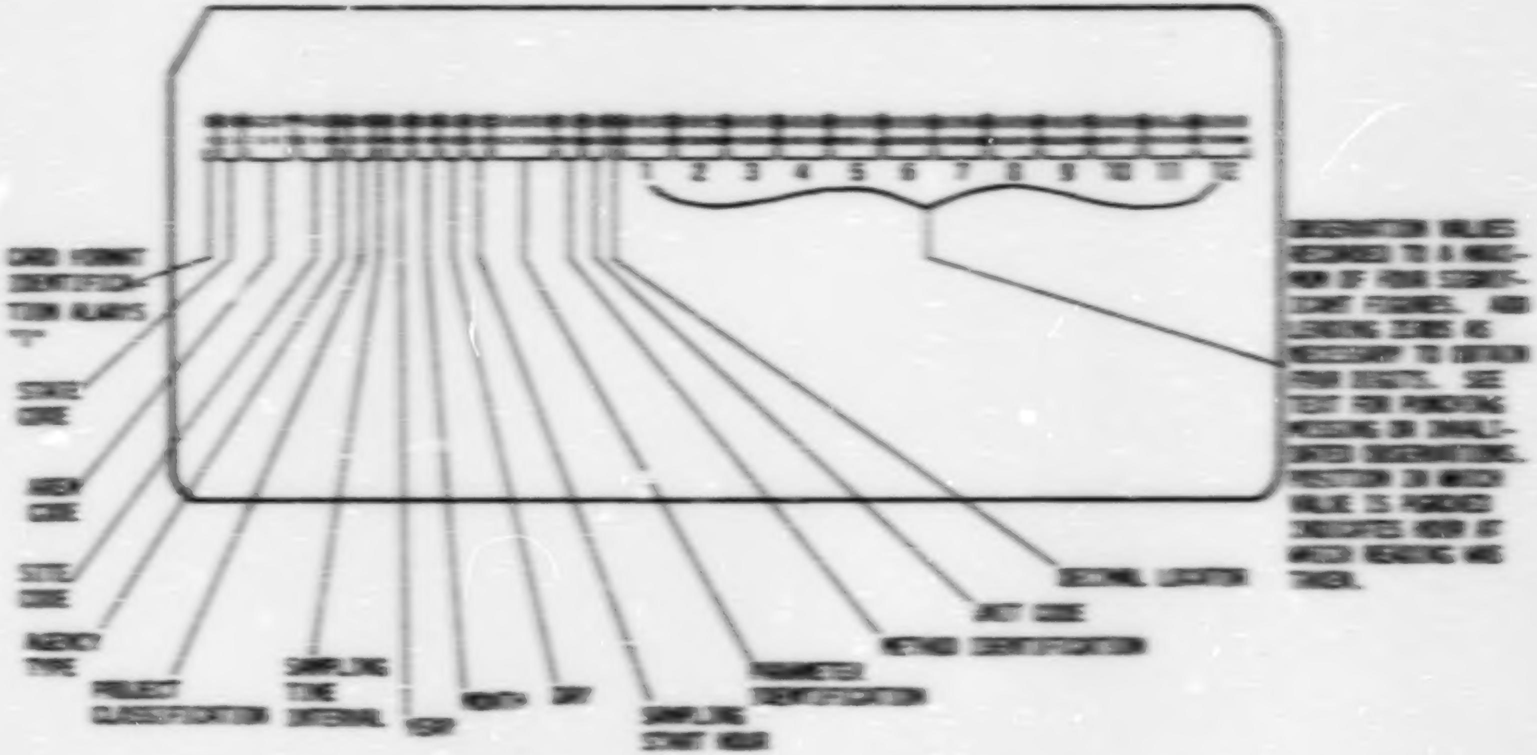
CARD FORMAT IDENTIFICATION ALWAYS "1"
STATE CODE
AREA CODE
SITE CODE
AGENCY TYPE
PROJECT CLASSIFICATION
SAMPLING TIME INTERVAL
YEAR
MONTH
DAY
SAMPLING START HOUR
PARAMETER IDENTIFICATION
METHOD IDENTIFICATION
UNIT CODE
DECIMAL LOCATION
1
2
3
4
5
6
7
8
9
10
11
12
OBSERVATION VALUES RECORDED TO A MAXIMUM OF FOUR SIGNIFICANT FIGURES. NO LEADING ZEROS IS NECESSARY TO OBTAIN FOUR DIGITS. SEE TEXT FOR PUNCHING MISSING OR SMALL-SIZED OBSERVATIONS. POSITION IN WHICH VALUE IS PUNCHED INDICATES HOUR AT WHICH READING WAS TAKEN.

FIGURE 2. CARD FORMAT USED FOR DATA RECORDED AT 1-, 2-, 3-, 4-, 6-, 8-, AND 12-HOUR INTERVALS

Table 2

GENERAL MASTER FILE ORGANIZATION

File	Description
1	SAROAD Ground Station Data for Ozone a. Connecticut b. Massachusetts c. New Hampshire d. Rhode Island e. Vermont f. New York g. New Jersey
2	EPA Ground Station
3	WSU Ground Station
4	Battelle Ground Station
5	Ground Bag Sample Analyses
6	Aircraft Data--Horizontal (Averages)
7	Aircraft Data--Vertical Profiles
8	Aircraft Bag Sample Analyses
9	Ozonesondes at Albany
10	Pibal--Vertical Wind Profiles a. Avery Point, Conn. b. Cambridge, Mass (MIT) c. West Springfield, Mass. d. Putnam, Conn.
11	Rawinsondes--Vertical Temperature and Wind Profiles
12	Raw Data File

Table 3 HEADER FOR SAROAD DATA

```
*
*************************************************************************
*                                                                       *
*        EPA SAROAD OZONE (44201) AND OXIDANT (44101) DATA              *
*                 15 JULY THROUGH 31 AUG 1975                           *
*                                                                       *
*************************************************************************
*                                                                       *
*                        ****** NOTES ******                             *
*   * STATION ID -- CROSS REFERENCE TABLE APPEARS BELOW                 *
*   * CORRESPONDING DATA APPEARS IN SAME ORDER                          *
* NO. STATION ID     STATION LOCATION        LON.    LAT.  ZONE UTMH UTMV *
* [illegible]                                                           *
*************************************************************************
```

Table 3 (Concluded) HEADER FOR [illegible] DATA

[illegible]

Table 4

```
1
********************************************************************************
*                                                                              *
*               EPA RESEARCH TRIANGLE PARK GROUND STATION DATA                 *
*                        13 JULY THROUGH 29 AUG 1975                           *
*                  CHICKATAWBUT HILL, BOSTON,MASSACHUSETTS                     *
*                       UTM ZONE 19 COORD (332,4678)                           *
*                                                                              *
********************************************************************************
*                                                                              *
*                             ****** NOTES *****                               *
*                                                                              *
*    * VALUES REPORTED FOR THE HOUR CORRESPOND TO SUCCEEDING HOURLY AVERAGE    *
*    * TIMES ARE EASTERN STANDARD                                              *
*    * STANDARD SAROAD CODES USED AS SUMMARIZED BELOW                          *
*                                                                              *
*           PARAMETER                  PARAMETER    METHOD    UNIT    DECIMAL  *
*          DESCRIPTION                   CODE        CODE     CODE    LOCATION *
*    1. UV RADIATION (LY/MIN)            63302        11       25        4     *
*    2. OZONE (PPB)                      44201        11       08        0     *
*    3. NITRIC OXIDE (PPB)               42601        14       08        0     *
*    4. NITROGEN DIOXIDE (PPB)           42602        14       08        0     *
*    5. METHANE (PPM)                    43201        11       07        1     *
*    6. CARBON MONOXIDE (PPM)            42101        90       07        1     *
*    7. BSCAT (BMS/CU M)                 11203        11       80        1     *
*    8. WIND DIRECTION (DEGREES)         61102        11       14        0     *
*    9. WIND SPEED (MPS)                 61101        11       11        1     *
*   10. TEMPERATURE (DEGREES C)          62101        20       17        1     *
*   11. RELATIVE HUMIDITY (PERCENT)      62201        20       19        0     *
*                                                                              *
********************************************************************************
```

Table 5

```
1

        WASHINGTON STATE UNIVERSITY GROUND STATION DATA
                 15 JULY THROUGH 22 AUG 1975
                 AVERY POINT, CONN (GROTON)
                 UTM ZONE 18 COORD (746,4577)


                       ****** NOTES *****

   * VALUES REPORTED FOR THE HOUR ARE AVERAGED BETWEEN ADJACENT HALF-HOURS
   * TIMES ARE EASTERN STANDARD
   * STANDARD SAROAD CODES USED AS SUMMARIZED BELOW

        PARAMETER                      PARAMETER   METHOD   UNIT     DECIMAL
        DESCRIPTION                      CODE       CODE    CODE    LOCATION
  1. OZONE (PPB)                         44201       11      08        0
  2. NITRIC OXIDE (PPB)                  42601       14      08        0
  3. NITROGEN DIOXIDE (PPB)              42602       14      08        0
  4. NONMETHANE HYDROCARBON (PPM)        43102       11      07        1
  5. CARBON MONOXIDE (PPM)               42101       21      07        1
  6. METHANE (PPM)                       43201       11      07        1
  7. FLUOROCARBON-11 (PPT)               98002       99      08        0
  8. CARBON TETRACHLORIDE (PPT)          98001       99      08        0
  9. WIND SPEED (MPS)                    61101       11      11        1
 10. WIND DIRECTION (DEGREES)            61102       11      14        0
 11. SIGMA THETA (DEGREES)               61106       23      14        0
 12. SOLAR RADIATION (LY/MIN)            63301       11      25        3
 13. TEMPERATURE (DEGREES C)             62101       23      17        1
 14. DEW POINT (DEGREES C)               62103       23      17        1
```

Table 6

```
****************************************************************************
*                                                                          *
*     BATTELLE COLUMBUS LABORATORIES GROUND STATION DATA                   *
*                    [illegible]                                           *
*                    [illegible]                                           *
*                    [illegible]                                           *
*                                                                          *
****************************************************************************
*                                                                          *
*                        ***** NOTES *****                                 *
*  * VALUES REPORTED FOR THE HOUR CORRESPOND TO SUCCEEDING HOURLY AVERAGE  *
*  * [illegible]                                                           *
*  * STANDARD SAROAD CODES USED AS SUMMARIZED BELOW                        *
*                                                                          *
*        PARAMETER            PARAMETER    METHOD    UNIT     DECIMAL      *
*        DESCRIPTION            CODE        CODE     CODE     LOCATOR      *
*  1: SOLAR RADIATION (LY/MIN)  [illegible] [illegible] [illegible] [illegible] *
*  2: WIND SPEED (MPH)          [illegible] [illegible] [illegible] [illegible] *
*  3: WIND DIRECTION (DEGREES)  [illegible] [illegible] [illegible] [illegible] *
*  4: [illegible]               [illegible] [illegible] [illegible] [illegible] *
*  5: RELATIVE HUMIDITY (PERCENT) [illegible] [illegible] [illegible] [illegible] *
*  6: OZONE (PPB)               [illegible] [illegible] [illegible] [illegible] *
*  7: NITRIC OXIDE (PPB)        [illegible] [illegible] [illegible] [illegible] *
*  8: NITROGEN DIOXIDE (PPB)    [illegible] [illegible] [illegible] [illegible] *
*  9: METHANE (PPM)             [illegible] [illegible] [illegible] [illegible] *
* 10: NONMETHANE HYDROCARBON (PPM) [illegible] [illegible] [illegible] [illegible] *
* 11: CARBON MONOXIDE (PPM)     [illegible] [illegible] [illegible] [illegible] *
* 12: [illegible]               [illegible] [illegible] [illegible] [illegible] *
* 13: [illegible]               [illegible] [illegible] [illegible] [illegible] *
* 14: [illegible]               [illegible] [illegible] [illegible] [illegible] *
* 15: [illegible]               [illegible] [illegible] [illegible] [illegible] *
* 16: [illegible]               [illegible] [illegible] [illegible] [illegible] *
* 17: [illegible]               [illegible] [illegible] [illegible] [illegible] *
* 18: FLUOROCARBON-11 (PPT)     [illegible] [illegible] [illegible] [illegible] *
* 19: CARBON TETRACHLORIDE (PPT) [illegible] [illegible] [illegible] [illegible] *
*                                                                          *
****************************************************************************
```

Table 7 FILE STRUCTURE FOR GROUND BAG SAMPLE DATA

- File Header (4 records)
- EPA Special Hydrocarbon Samples (Header 01)
    - Day 1 (July 16)
    - Day 2 (July 17)
- EPA Diurnal Hydrocarbon Samples (Header 02)
    - Day 1 (July 18)
    - Day 2
    - |
    - Day N (August 21)
- EPA Freon-11, CCl_4, PAN Samples (Header 03)
    - Day 1 (July 18)
    - Day 2
    - |
    - Day N (August 29)
- WSU Special Hydrocarbon Samples (Header 01)
    - Day 1 (July 15)
    - Day 2
    - |
    - Day N (August 20)

Table 8 GROUND BAG SAMPLE FORMATS AND CODES

```
A.      GROUND STATION DATA -- BAG SAMPLES
****************************************************************************************
    AGENCY CODE:
    01  EPA LAS VEGAS
    02  EPA RESEARCH TRIANGLE PARK
    03  EPA REGION I
    04  WASHINGTON STATE UNIVERSITY
    05  BATTELLE COLUMBUS LABORATORIES
    06  RESEARCH TRIANGLE INSTITUTE
****************************************************************************************
    LOCATION CODE:
00                                              50  TRAILER SITE [illegible]
01  CHICKATAWBUT HILL                           51  TRAILER SITE [illegible]
02  DANVERS                                     52  TRAILER SITE [illegible]
03  JFK BUILDING                                53  TRAILER SITE [illegible]
04  [illegible]                                 54  TRAILER SITE [illegible]
05  DOWNTOWN BOSTON                             55  TRAILER SITE [illegible]
06                                              56  TRAILER SITE [illegible]
07                                              57  TRAILER SITE [illegible]
08                                              58  TRAILER SITE [illegible]
09                                              59  TRAILER SITE [illegible]
10                                              60  INLAND SITE  [illegible]
11  ALBANY AIRPORT                              61  INLAND SITE  [illegible]
12                                              62  INLAND SITE  [illegible]
13                                              63  INLAND SITE  [illegible]
14                                              64  INLAND SITE  [illegible]
15                                              65  INLAND SITE  [illegible]
16                                              66  INLAND SITE  [illegible]
17                                              67  INLAND SITE  [illegible]
18                                              68  INLAND SITE  [illegible]
19                                              69  INLAND SITE  [illegible]
20                                              70  RURAL SITE   [illegible]
21                                              71  RURAL SITE   [illegible]
22                                              72  RURAL SITE   [illegible]
23                                              73  RURAL SITE   [illegible]
24                                              74  RURAL SITE   [illegible]
25                                              75  RURAL SITE   [illegible]
26                                              76  RURAL SITE   [illegible]
27                                              77  RURAL SITE   [illegible]
28                                              78  RURAL SITE   [illegible]
29                                              79  RURAL SITE   [illegible]
30                                              80  URBAN SITE   [illegible]
31                                              81  URBAN SITE   [illegible]
32                                              82  URBAN SITE   [illegible]
33                                              83  URBAN SITE   [illegible]
34                                              84  URBAN SITE   [illegible]
35                                              85  URBAN SITE   [illegible]
36                                              86  URBAN SITE   [illegible]
37                                              87  URBAN SITE   [illegible]
38                                              88  URBAN SITE   [illegible]
39                                              89  URBAN SITE   [illegible]
40                                              90  RT. 1 TUNNEL
41                                              91  HIGHWAY & ROADWAY
42                                              92  CALLAHAN TUNNEL
43                                              93  HIGHWAY 1-TUNNEL
44                                              94  HIGHWAY 1
45                                              95  RT. 1 HWY 1 TUNNEL
46                                              96  SUMNER TUNNEL
47                                              97
48                                              98
49                                              99  UNKNOWN
```

Table 8 (Continued) GROUND BAG SAMPLE FORMATS AND CODES

```
LOCATION DESCRIPTIONS (UTM ZONE;UTM X COORD;UTM Y COORD) **
00       DANVERS,MASS. (19;[illegible];[illegible])
01       BOSTON,MASS. (19;[illegible];[illegible])
02       BOSTON,MASS. (19;[illegible];[illegible])
03       [illegible] (19;[illegible];[illegible])
04       BOSTON,MASS (19;[illegible];[illegible])
05       BOSTON,MASS (19;[illegible];[illegible])
11       [illegible] (19;[illegible];[illegible])
[illegible]    TRAILER SITE (18;[illegible];[illegible])
         AVON,CONN
[illegible]    INLAND SITE (18;[illegible];[illegible])
         DEVILS HOPYARD STATE PARK,CONN
[illegible]    BOSTON,MASS (19;[illegible];[illegible])
**********************************************************************
UNITS:

HYDROCARBON BAG SAMPLES (01-99) =
         UGU = MICROGRAMS/CUBIC CENTIMETER
         ALL OTHER ANALYSES = PPB CARBON
FREON 11 = PARTS PER TRILLION (PPT)
CCL4     = PARTS PER TRILLION (PPT)
PAN      = PARTS PER BILLION (PPB)
**********************************************************************
    POLLUTANT SAMPLE CODE:
01 ETHANE                      23 N-HEXANE                     45 M-XYLENE
02 ETHYLENE                    24 HEXENE-1                     46 O-XYLENE
03 PROPANE                     25 T-HEXENE-2                   47 N-NONANE
04 ACETYLENE                   26 2,4-DIMETHYLPENTANE          48 ISOPROPYLBENZENE
05 ISOBUTANE                   27 METHYLCYCLOPENTANE           49 N-PROPYLBENZENE
06 N-BUTANE                    28 CIS-HEXENE-2                 50 M,P-ETHYLTOLUENE
07 PROPYLENE                   29 PROPIONALDEHYDE              51 1,3,5-TRIMETHYLBENZENE
08 ISOBUTYLENE                 30 ACETONE                      52 O-ETHYLTOLUENE
09 [illegible]                 31 [illegible]                  53 1,2,4-TRIMETHYLBENZENE
10 [illegible]-BUTADIENE       32 CYCLOHEXANE                  54 [illegible]
11 ISOPENTANE                  33 [illegible]                  55 [illegible]
12 N-PENTANE                   34 [illegible]                  56 [illegible]
13 PENTENE-1                   35 [illegible]                  57 [illegible]
14 [illegible]                 36 [illegible]                  58 [illegible]
15 [illegible]                 37 [illegible]                  59 [illegible]
16 [illegible]                 38 [illegible]                  60 [illegible]
17 [illegible]                 39 N-HEPTANE                    61 [illegible]
18 [illegible]                 40 METHYLCYCLOHEXANE            71 [illegible]
19 [illegible]+ISOPRENE        41 TOLUENE                      72 [illegible]
20 [illegible]                 42 [illegible]                  73 PAN
21 [illegible]                 43 ETHYLBENZENE                 74 PARAFFINS
22 [illegible]                 44 P-XYLENE                     99 UNKNOWN

NOTE:
COMPOUND [illegible] AND [illegible] ARE THE SAME COMPOUND
COMPOUND [illegible] AND [illegible] ARE THE SAME COMPOUND
COMPOUND [illegible] AND [illegible] ARE THE SAME COMPOUND
[illegible] IS A PROBLEM THAT HAS NOT YET BEEN ADDRESSED
[illegible]
[illegible]
[illegible] IS THE RESULT OF [illegible] SURFACE OUTGASSING.
[illegible]
[illegible] MEASUREMENTS WERE [illegible]
[illegible]
[illegible] HIGH VALUES.
```

Table 8 (Concluded) GROUND BAG SAMPLE FORMATS AND CODES

```
(LONNEMAN,1976)
**************************************************************************
   DATA FORMATS:
       EACH DATA SET STARTS WITH A HEADER CARD, CONTAINS MANY DATA
   CARDS, AND IS TERMINATED WITH A BLANK CARD. THE FORMATS FOR THE
   VARIOUS DATA SETS IS GIVEN BELOW.

        HEADER CARDS:
 01 AA DDDDDD NN NP LLSSSSFFFFLLSSSSFFFFLLSSSSFFFFLLSSSSFFFF
 02 AA DDDDDD  LL RRR SSSS
 03 AA DDDDDD  LL RRR SSSS
 07 AA DDDDDD
        WHERE
  AA = AGENCY CODE
  DDDDDD = DATE; YEAR,MONTH,DAY
  NN = NUMBER OF CARDS IN THIS SET
  NP = NUMBER OF SITES
  LL = LOCATION CODE
  SSSS =  START TIME; HOURS,MINUTES
  FFFF =  FINISH TIME; HOURS,MINUTES
  RRR  =  SAMPLE RATE; MINUTES

        DATA CARDS:
 01 CC   XXX.X XXX.X XXX.X XXX.X XXX.X
 02 CC   VVV.V  ETC.
 05 TTTTKKJJJJJJKKKKKKPPPPPP
 07 TTTT  OZONE?NO????NO2???NMHC??CO????CH4???FCL3?CCL4?WS????WDIR?SIGTHRAD??TEMP?DP???
        WHERE
  CC = POLLUTANT SAMPLE CODE
  XXX.X = DATA VALUE
  VVV.V = DATA VALUE
  TTTT = TIME ; HOURS,MINUTES
  JJJJJJ = FREON
  KKKKKK = CCL4
  PPPPPP = PAN
  OZONE = OZONE
  NO??? = NITRIC OXIDE
  NO2?? = NITROGEN DIOXIDE
  NMHC? = NON-METHANE HYDROCARBONS
  CO??? = CARBON MONOXIDE
  CH4?? = METHANE
  FCL3? = FREON 11
  CCL4? = CARBON TETRACLORIDE
  WSPD? = WIND SPEED
  WDIR? = WIND DIRECTION
  SIGTH = SIGMA THETA
  RAD?? = RADIATION
  TEMP? = TEMPERATURE
  DP??? = DEW POINT
**************************************************************************

  NOTE:  BLANK SPACE MEANS NO REPORTED DATA

  NOTE -- ALL TIMES FOR THIS DATA SET ARE EASTERN DAYLIGHT (EST+1).
  THIS WAS NECESSARY TO ALLOCATE MULTI-HOUR AVERAGES TO THE SAME CALENDAR DAY.

**************************************************************************
```

Table 9 HORIZONTAL AIRCRAFT DATA (GENERAL FORMAT)

```
Header Record

EPA

    Flight 1

        Header (one card)
        Data Card 1
        Data Card 2
            |
        Data Card N
        Blank (one card)

    Flight 2

        Header
        Data Card 1
            |
        Data Card N
        Blank (one card)

    Flight 19

        Header
        Data Card 1
            |
        Data Card N
        Blank (one card)

WSU

    Flight 1

        Header (one card)
        Data Card 1
            |
        Data Card N
        Blank (one card)
            |
    Flight 52
            |
        Blank (one card)

Battelle (45 flights)
            |
ISU (19 flights)
```

Table 10

```
1      AIRCRAFT HORIZONTAL DATA
***************************************************************************
   AIRCRAFT TYPE CODE:
    1 EPA LAS VEGAS
    2 WASHINGTON STATE UNIVERSITY
    3 BATTELLE COLUMBUS LABORATORIES
    4 INTERSTATE SANITATION COMMISSION
***************************************************************************
   DATA FORMATS:
        EACH DATA SET STARTS WITH A HEADER CARD, CONTAINS MANY DATA
   CARDS, AND IS TERMINATED WITH A BLANK CARD. THE FORMATS FOR THE
   VARIOUS DATA SETS IS GIVEN BELOW.

        HEADER CARD
   A    M    DD    FF
        WHERE
  A = AIRCRAFT CODE (SEE ABOVE)
  M = MONTH - 7=JULY, 8=AUGUST
  DD = DAY
  FF = FLIGHT NUMBER

        DATA CARDS
          001
ZZXXYYTTTTT,AAAAAA,DDDDDDD,OOOOOOO,NNNNNN,SSSSSS,BBBBBB,UUUUUU,LLLLLL
          002
ZZXXYYTTTTT,AAAAAA,DDDDDDD,OOOOOOO,RRRRRR,NVVVVVV,VLLLLLL
          003
ZZXXYYTTTTT,AAAAAA,SSSSSSS,SO 3000,OLLLLLL
          002
ZZXXYYTTTTT,AAAAAA,DDDDDDD,OLLLLLL
        WHERE
  ZZ = LAST DIGIT OF UTM ZONE
  XX = FIRST TWO DIGITS OF UTM X COORD (KM)
  YY = SINGLE TWO DIGITS OF UTM Y COORD (KM)
  TTTT = TIME (EST)
  AAAAAA.A = ALTITUDE (METERS)
  DDDDDD.D = DEW POINT (DEGREES C)
  OOOOOO.O = OZONE (PPB)
  NNNNNN.N = NO (PPB)
  SSSSSS.S = TEMPERATURE (DEGREES C)
  UUUUUU.U = BSCAT (1/10**4/M)
  RRRRRR.R = RELATIVE HUMIDITY (PERCENT)
  NNNNNN.N = NUMBER OF PARTICLES  (1000/CM3)
  VVVVVV.V = VISUAL DISTANCE (KM)
  LLLLLL   = NUMBER OF DATA POINTS IN THIS 10 KM BY 10 KM GRID SQUARE
***************************************************************************
```

Table 11 VERTICAL AIRCRAFT DATA (GENERAL FORMAT)

```
Header Record
EPA (19 flights)
    Flight N
        Sounding 1
            Header (one card)
            Parameter 1 (N cards)
            Parameter 2
               |
            Parameter 5
            Blank (one card)
        Sounding 2
            Header
            Parameter 1
               |
            Parameter 5
            Blank (one card)
               |
        Sounding N
            Header
            Parameter 1
               |
            Parameter 5
            Blank (one card)
               |
    Flight N+1
               |
WSU (52 flights)
    Flight N
        Sounding 1
            Header (one card)
            Parameter 1 (N cards)
            Parameter 2
            Blank (one card)
               |
        Sounding N
               |
            Blank (one card)
Battelle (45 flights, 4 parameters)
               |
IBC (19 flights, 2 parameters)
```

Table 11. AIRCRAFT DATA (VERTICAL PROFILES) - FORMATS AND CODES

1 AIRCRAFT VERTICAL PROFILES

AIRCRAFT TYPE CODES:

1 EPA LAS VEGAS
2 WASHINGTON STATE UNIVERSITY
3 BATTELLE COLUMBUS LABORATORIES
4 INTERSTATE ELECTRONICS CORPORATION

DATA FORMATS:

EACH DATA SET STARTS WITH A HEADER CARD, CONTAINS MANY DATA CARDS, AND IS TERMINATED WITH A BLANK CARD. THE FORMATS FOR THE VARIOUS DATA SETS IS GIVEN BELOW.

HEADER CARDS:
[illegible] -1 TIME LOCX LOCY
WHERE
A = AIRCRAFT CODE (SEE ABOVE)
M = MONTH - 7=JULY, 8=AUGUST
DD = DAY
FF = FLIGHT NUMBER
TIME = TIME IN HOURS,MINUTES
LOCX = UTM X COORDINATE
LOCY = UTM Y COORDINATE

DATA CARDS:
[illegible]
WHERE
AAAA = ALTITUDE (METERS)
YYYY = DATA VALUE
[illegible] [illegible] O3 (PPB)
[illegible] NO (PPB)
[illegible] TEMPERATURE (DEGREES C)
[illegible] DEW POINT (DEGREES C)
[illegible] [illegible]

[illegible] [illegible] O3 (PPB)
[illegible] TEMPERATURE (DEGREES C)

Table 13. AIRCRAFT BAG SAMPLE FORMATS AND CODES

2 AIRCRAFT BAG SAMPLES

AGENCY CODES:

01 EPA LAS VEGAS
02 EPA RESEARCH TRIANGLE PARK
03 EPA REGION I
04 WASHINGTON STATE UNIVERSITY
05 BATTELLE COLUMBUS LABORATORIES
06 RESEARCH TRIANGLE INSTITUTE

UNITS:

HYDROCARBON BAG SAMPLES (01-69) -
WSU - MICROGRAMS/CUBIC CENTIMETER
ALL OTHER AGENCIES - PPB CARBON
FREON 11 - PARTS PER TRILLION (PPT)
CCL4 - PARTS PER TRILLION (PPT)
PAN - PARTS PER BILLION (PPB)

POLLUTANT SAMPLE CODE (CD) :

01 ETHANE
02 ETHYLENE
03 PROPANE
04 ACETYLENE
05 ISOBUTANE
06 N-BUTANE
07 PROPYLENE
08 ISOBUTYLENE
09 T-BUTENE-2
10 C-BUTENE-2-[illegible]
11 ISOPENTANE
12 N-PENTANE
13 PENTENE-1
14 2-METHYLBUTENE-1
15 T-PENTENE-2
16 C-PENTENE-2
17 2-METHYLBUTENE-2
18 ACETALDEHYDE
19 CYCLOPENTANE-[illegible]
20 2-METHYLPENTANE
21 3-METHYLPENTANE
22 4-METHYLPENTENE-1
23 N-HEXANE
24 HEXENE-1
25 T-HEXENE-2
26 2,4-DIMETHYLPENTANE
27 METHYLCYCLOPENTANE
28 CIS-HEXENE-2
29 METHYLCHLOROFORM
30 BENZENE
31 3,3-DIMETHYLPENTANE
32 CYCLOHEXANE
33 2-METHYLHEXANE
34 2,3-DIMETHYLPENTANE
35 3-METHYLHEXANE
36 1C3 DIMETHYLCYCLOPENTANE
37 2,2,4-TRIMETHYLPENTANE
38 1T3-DIMETHYLCYCLOPENTANE
39 N-HEPTANE
40 METHYLCYCLOHEXANE
41 TOLUENE
42 OCTANE
43 ETHYLBENZENE
44 P-XYLENE
45 M-XYLENE
46 O-XYLENE
47 N-NONANE
48 ISOPROPYLBENZENE
49 N-PROPYLBENZENE
50 M,P-ETHYLTOLUENE
51 1,3,5 TRIMETHYLBENZENE
52 O-ETHYLTOLUENE
53 1,2,4-TRIMETHYLBENZENE
54 N-DECANE
55 OZONE PPM
56 PROPYNE
57 NEO-HEXANE
58 1-BUTYNE
59 2-BUTYNE
60 [illegible]
61 [illegible]
71 CFCL3
72 CCL4
73 PAN
74 [illegible]
99 UNKNOWN

Table 13 (Concluded). AIRCRAFT BAG SAMPLE FORMATS AND CODES

```
NOTES:
COMPOUNDS [illegible] AND [illegible] ARE THE SAME COMPOUND
COMPOUNDS [illegible] AND [illegible] ARE THE SAME COMPOUND
COMPOUNDS [illegible] AND [illegible] ARE THE SAME COMPOUND
** THE CORRECT LABELING OF UNKNOWN IS A PROBLEM THAT HAS NOT YET BEEN ADDRESSED
THAT IS, THE CORRECT LABELING OF UNKNOWN PEAKS FROM CHROMATOGRAM TO CHROMATO-
GRAM IS A FUNCTION OF RETENTION TIME AND ALSO THE NUMBER OF UNKNOWN PEAKS PER
SAMPLE. THIS MISLABELING IS THE RESULT OF INCONSISTENT GAS SURFACE [illegible]
[illegible]
```

```
    DATA FORMATS:
         EACH DATA SET STARTS WITH A HEADER CARD, CONTAINS MANY DATA
    CARDS, AND IS TERMINATED WITH A BLANK CARD. THE FORMATS FOR THE
    VARIOUS DATA SETS IS GIVEN BELOW.

         HEADER CARDS:


[illegible] AA YYMMDD  FF  NN  [illegible]
[illegible] AA YYMMDD [illegible] TTTT TTTT TTTT TTTT TTTT TTTT TTTT TTTT TTTT
        WHERE
 AA = AGENCY CODE
 YYMMDD = DATE: YEAR-MONTH-DAY
 FF = FLIGHT NUMBER
 NN = NUMBER OF BAG SAMPLES TAKEN
 TTTT = TIMES AT WHICH THE BAG SAMPLE WAS TAKEN

        DATA CARDS:
 [illegible] CC    [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] (PRECEDED BY [illegible] HEADER)
CC  [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]       (PRECEDED BY [illegible] HEADER)
        WHERE
 CC = POLLUTANT SAMPLE CODE
 [illegible] = DATA VALUE
 [illegible] = DATA VALUE
```

Table [illegible]. FORMATS AND CODES FOR [illegible] [illegible]

1   [illegible] DATA

AGENCY CODES

01 EPA LAS VEGAS
02 EPA RESEARCH TRIANGLE PARK
03 EPA REGION I
04 WASHINGTON STATE UNIVERSITY
05 BATTELLE COLUMBUS LABORATORIES
06 RESEARCH TRIANGLE INSTITUTE

DATA QUALITY CODES
BLANK = VALID DATA
1 = [illegible] [illegible] [illegible] [illegible] VALID DATA

DATA FORMATS

EACH DATA SET STARTS WITH A HEADER CARD, CONTAINS MANY DATA CARDS, AND IS TERMINATED WITH A BLANK CARD. THE FORMATS FOR THE VARIOUS DATA SETS IS GIVEN BELOW.

HEADER CARDS

[illegible] [illegible] TIME [illegible] [illegible]

WHERE
AA = AGENCY CODE
[illegible] = DATE YEAR-MONTH-DAY
TIME = TIME [illegible]
QQ = DATA QUALITY CODE
[illegible] = [illegible] [illegible]

DATA CARDS

[illegible] [illegible] [illegible] [illegible] [illegible] BLANK

WHERE
LL = LEVEL NUMBER
[illegible] = ATMOSPHERIC PRESSURE (MILLIBARS)
[illegible] = TEMPERATURE (DEGREES C)
[illegible] = HEIGHT (METERS)
WD = WIND DIRECTION (DEGREES)
WS = WIND SPEED (METERS/SEC)
BLANK = [illegible] [illegible]

Table 15 PIBAL HEADER

```
I  PIBAL WIND DATA
****************************************************************************
 UTM LOCATIONS OF PIBAL RELEASE POINTS
                      ZONE        UTM-X        UTM-Y
MIT, BOSTON,MASS.      19          328         4692
WEST SPRINGFIELD       18          697         4665
PUTNAM, CONN.          19          260         4645
AVERY POINT, CONN.     18          746         4578

   DATA FORMAT:
        A DATA SET CONSISTS OF TWO HEADER CARDS AND ONE OR MORE DATA CARDS.

         HEADER CARDS:
    THE DATA ON THE HEADER CARDS CONSISTS OF TIME,DATE,AND PLACE OF
    LAUNCH IN TEXT FORMAT.

         DATA CARDS:
    MMMMMM.,IIIIII.,UUUU.U,VVVV.V,WWWWWWWW.,XXXXXX.X,YYYYYY.Y.
          WHERE
MMMMMM. = MID POINT OF LAYER HEIGHT (METERS)
IIIIII. = MID POINT OF LAYER HEIGHT (FEET)
UUUU.U  = U COMPONENT (METERS/SEC)
VVVV.V  = V COMPONENT (METERS/SEC)
WWWWWWWW. = WIND DIRECTION (DEGREES)
XXXXXX.X = WIND SPEED (METERS/SEC)
YYYYYY.Y = WIND SPEED (MILES/HOUR)

****************************************************************************
```

Table 16 RADIOSONDE DATA

```
1        RADIOSONDE DATA
------------------------------------------------------------------------------------------
LOCATION OF STATIONS BY BLOCK AND STATION NUMBER:
     14685   CHATHAM,MASS.
     14611   BRUNSWICK,MAINE
     14765   PROVIDENCE,R.I.
     14739   BOSTON,MASS.

   DATA FORMAT:
        EACH DATA RECORD CONSISTS OF ONE CARD OF DATA

   DATA CARDS:
BBBBBYYMMDDTTLL      CCCCRRRHHHHH      PPPPP       WWWSSS
        WHERE
 BBBBB = BLOCK NUMBER AND STATION NUMBER
 YY = YEAR
 MM = MONTH
 DD = DAY
 TT = TIME (EST)
 LL = LEVEL NUMBER
 CCCC = TEMPERATURE (TENTHS OF A DEGREE C)
 RRR = RELATIVE HUMIDITY (PER CENT)
 HHHHH = HEIGHT (METERS)
 PPPPP = PRESSURE (TENTHS OF MILLIBARS)
 WWW = WIND DIRECTION (DEGREES)
 SSS = WIND SPEED (METERS PER SECOND)
------------------------------------------------------------------------------------------
```

IV RAW DATA FILE

Individual aircraft observations (data) constitute a raw data file starting in File 12 of the Master File tape. The organization for the individual files follows:

Files	Description
12- 41	EPA (19 flights)
42- 93	WSU (52 flights)
94-112	ISC (19 flights)

There is no raw data file for Battelle since all their reported data (Spicer et al., 1976) are, in effect, listed in the Master File.

The EPA data (Siple et al., 1976) were recorded in situ on magnetic tape in 5-second intervals. These data were validated, converted to engineering units, and reformatted before storage in the raw data file. The WSU data were digitized from graphs in the WSU final report (Washington State University, 1976). The ISC data were keypunched from tabulation in the ISC final report (Interstate Sanitation Commission, 1975).

The formats for the three types of flights (EPA, WSU, ISC) appear as Tables 17, 18, and 19. The file header appears as the first physical record in the first file of each type (Files 12, 42, and 94, respectively).

Table 17 EPA AIRCRAFT RAW DATA FORMAT

```
1      COMPLETE EPA AIRCRAFT DATA SET
---------------------------------------------------------------------------
 19 FILES OF EPA AIRCRAFT DATA

 11 ITEMS PER 80 COLUMN CARD IMAGE -- FORMAT(I4,I7,I10,8F7.1)

 ITEM 1 = DATE
 ITEM 2 = TIME (EST)
 ITEM 3 = STATUS
 ITEM 4 = LOCATION UTM X COORD (KM)
 ITEM 5 = LOCATION UTM Y COORD (KM)
 ITEM 6 = OZONE (PPM)
 ITEM 7 = NO (PPM)
 ITEM 8 = TEMPERATURE (DEGREES C)
 ITEM 9 = DEW POINT (DEGREES C)
 ITEM 10 = BSCAT (1.E-4/METER)
 ITEM 11 = ALTITUDE (METERS)
---------------------------------------------------------------------------
```

Table 18 WSU AIRCRAFT RAW DATA FILE

```
1       COMPLETE WASHINGTON STATE UNIV AIRCRAFT DATA SET
*******************************************************************************
 52 FILES OF WSU AIRCRAFT DATA
 EACH FILE CONSISTS OF A HEADER CARD FOLLOWED BY DATA CARDS

 HEADER FORMAT (4I4) :
   S    M    DD    FF
        WHERE
 S = AIRCRAFT CODE
 M = MONTH
 DD = DAY
 FF = FLIGHT NUMBER

 DATA FORMATS (I7,F8.2,7F8.1)
   LLL  HHMM.SS  XXXX.X  YYYY.Y  AAAA.A  OOOO.O  HHHH.H  TTTT.T  DDDD.D
        WHERE
 LLL = DATAPOINT NUMBER
 HH = HOUR (EST)
 MM = MINUTES
 SS = SECONDS
 XXXX.X = X UTM COORD (KM)
 YYYY.Y = Y UTM COORD (KM)
 AAAA.A = ALTITUDE (FEET)
 OOOO.O = OZONE (PPB)
 HHHH.H = RELATIVE HUMIDITY (PERCENT)
 TTTT.T = NUMBER OF PARTICLES [illegible]
 DDDD.D = VISUAL DISTANCE (KM)

*******************************************************************************
```

Table 19 ISC AIRCRAFT RAW DATA FILE

```
1       COMPLETE INTERSTATE SANITATION COMMISSION AIRCRAFT DATA SET
***********************************************************************
16 FILES OF ISC AIRCRAFT DATA
EACH FILE CONSISTS OF A HEADER CARD FOLLOWED BY DATA CARDS

HEADER FORMAT (5I2) )
  S    M    DD    FF    NN
      WHERE
S = AIRCRAFT CODE
M = MONTH
DD = DAY
FF = FLIGHT NUMBER
NN = NUMBER OF VARIABLES

DATA FORMATS (I7,F9.2,7F8.1)
  LLL  HHMM.SS  XXXX.X  YYYY.Y  AAAA.A  TTTT.T  OOOO.O
      WHERE
LLL = DATAPOINT NUMBER
HH = HOUR (EST)
MM = MINUTES
SS = SECONDS
XXXX.X = X UTM COORD (KM)
YYYY.Y = Y UTM COORD (KM)
AAAA.A = ALTITUDE (FEET)
TTTT.T = TEMPERATURE (DEGREES F)
OOOO.O = OZONE (PPB)
***********************************************************************
```

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Appendix A

WEATHER CONDITIONS PREVAILING DURING FLIGHT OPERATIONS

Table A1 WEATHER CONDITIONS PREVAILING DURING WASHINGTON STATE UNIVERSITY FLIGHTS

Date 1975	Time (EDT) Start	Time (EDT) End	Flight Number	Flight Area	Weather
July 15	1530	1700	1	Groton, L.I.	West side of HI with a stationary front just N of track
18	1325	1532	2	Groton local	NW side of HI, S-westerly flow
18	1541	1708	3	Groton-E. Conn.	Same as above
19	0935	1315	4	Groton, L.I., W. Conn.	Same as above
19	1545	1812	5	E. Conn., R.I., E. Mass.	Same as above; squall line 350 mi NW
20	1432	1632	6	Groton, L.I.	Track lies in large trough on back side of high. Cold front 270 mi NW
20	1930	2030	7	Groton local	Track lies in large trough on back side of high. Cold front 210 mi NW
21	1100	1415	8	Groton, R.I., E. Mass.	In complex low, just behind cold front, secondary cold front 180 mi NW
21	1542	1814	9	Groton, L.I.	Cold front moving east, secondary now trough 120 mi NW
22	0735	0915	10	Groton, L.I. sound	Trough passed 8 hrs. before. Track 90 mi behind cold front
22	1315	1555	11	Groton, L.I.	East side of small HI, cold front now 180 mi SE
23	0805	1145	12	Groton, R.I., E. Mass.	North side weak HI, cold front approaching 270 mi NW
23	1520	1710	13	E. Conn., L.I.	Now in trough, cold front 240 mi NW S.westerly flow
24	0915	1230	14	R.I., Boston circle	Back side of HI, S'LY flow deepening low 830 mi NW
25	1520	1720	15	R.I., Boston circle	Back side of HI, S'LY flow deepening low 600 mi NW; cold front now 210 mi NW
26	0940	1250	16	R.I., Boston 1/2 circle	East side of HI, behind cold front that passed 13 hr. before
26	1500	1805	17	R.I., Boston circle	East side of HI, behind cold front that passed 13 hr. before
27	0910	1215	18	R.I., Boston circle	Hurricane 300 mi SE moving NE
27	1450	1755	19	R.I., Boston circle	In col between hurricane 270 mi SE and low 600 mi NW
28	1005	1145	20	Groton, L.I.	In low, cold front 100 mi NW, SW'LY flow
28	1430	1720	21	Groton, L.I.	Cold front across track
29	0920	1220	22	Groton, R.I., Boston circle	East side of HI behind cold front 130 mi SE, passed 18 hr. before
29	1435	1735	23	Groton, R.I., Boston circle	Same as above
30	2105	2255	24	Groton, R.I.	W. side of large high, S'LY flow

Table A1 WEATHER CONDITIONS PREVAILING DURING WASHINGTON STATE UNIVERSITY FLIGHTS (Concl.)

Date 1975	Time (EDT) Start	 End	Flight Number	Flight Area	Weather
August 2	1200	1540	25	Groton, Mass.; Cape Cod	N side of large HI
2	2035	2320	26	Groton, Mass.; Cape Cod	Same as above
3	1005	1320	27	Groton-Boston circle	Weak low with stationary front across track
5	1250	1635	28	Groton, L.I. sound	60 mi behind cold front that passed 6 hrs. before secondary cold front 180 mi NW
6	0905	1205	29	Groton, R.I., 1/2 Boston circle	50 mi behind cold front that passed 12 hrs. before
6	1600	1645	30	Groton, R.I., 1/2 Boston circle	W'LY flow behind front, low centered 200 mi NW, HI 800 WSW
9	1150	1500	31	Groton, L.I.	NE side of HI, W'LY flow
9	1530	1800	32	Groton, L.I.	Same as above
10	1110	1510	33	Groton, L.I.	N side of large HI, W'LY flow
10	1605	1900	34	Groton, L.I.	N side of large HI, W'LY flow, cold front 280 mi NW
11	0920	1215	35	Groton, L.I.	trough just west of track
12	0925	1235	36	Groton, Boston circle	In weak low centered NE stationary front 180 mi NW
12	1515	1705	37	Groton, L.I.	Same as above
13	0900	1220	38	W. Conn., L.I.	N. side large HI, W'LY flow, cold front approaching 400 mi NW
13	1540	1830	39	SW Conn., L.I., coast	Squall line 100 mi West SW'LY flow
14	0935	1300	40	W. Conn., S. L.I.	Cold front across track
14	1545	1845	41	SW Conn., L.I., coast	Just behind cold front
15	1015	1320	42	Groton, S. L.I., station 1	East side of HI, NW'LY flow, low 600 W
15	1700	1830	43	Groton, S. L.I., station 1	Near center of HI, low 500 mi W
18	1035	1330	44	Groton, W. Conn.	Just E of cold front, W'LY flow
18	1940	2030	45	Groton local	30 mi W. of cold front
19	1000	1320	46	Groton, L.I., S. Mass.	East edge of high, Westerly flow
19	1630	1715	47	Groton, L.I., S. Mass.	Same as above
19	1905	2220	48	Groton, NYC loop	Same as above
20	1200	1445	49	Groton, Boston circle	Same as above
20	1615	1905	50	Groton, S. Mass.	Same as above
21	0910	1150	51	Groton, Boston circle	North side of HI, weak gradient
21	1440	1635	52	Groton, E. over water	NW side of HI, S'LY flow

Table A2 WEATHER CONDITIONS PREVAILING DURING BATTELLE FLIGHTS

Date 1975	Time (EDT) Start	Time (EDT) End	Flight Number	Flight Area	Weather
JULY 18	1930	2230	2	Mass., Vt., Conn.	Backside of stationary HI centered over Atlantic
20	0817	1106	3	Mass., Conn.	SW flow backside of Atlantic high Cold front 180 mi NW
21	1720	2020	4	Mass., Vt., Conn.	In a trough with dissipating secondary cold front across track
22	0830	1043	5	Long Is., NYC	In a trough following weak cold front weak high to west
22	1400	1530	6	Long Is., NYC	Leading edge of weak high centered to west
23	0910	1225	7	Mass., Vt., Conn.	Cold front approaching 130 mi NW, Weak pressure gradient over area
23	1426	1713	8	Mass., Vt., Conn.	Cold front 100 mi NW
24	0910	1133	9	Mass., Vt., Conn.	Deepening low approaching from west (warm front north)
24	1504	1830		Atlantic Coast, N.	Same as above, Cold front 180 mi west
26	0905	1227	11	Mass., Vt., Conn.	Leading edge of HI following cold front now 190 mi SE
26	1220	1812	12	Mass., Vt., Conn.	Same as above, Cold front 220 SE
27	0927	1242	13	Mass., Vt., Conn.	Ridge between 2 lows--one a tropical storm 363 mi SE
27	1306	1613	14	Mass., Vt., Conn.	Same as above
28	0925	1123	15	Hudson River, E. Conn.	Cold front approaching--just west of track
28	1342	1627	16	Followed Conn. River to ocean	Cold front across track
29	0912	1237	17	Mass., Vt., Conn.	East side of high--cold front 120-130 mi SE
29	1437	1735	18	Mass., Vt., Conn.	Same as above
31	1350	1715	19	Hartford, Columbus, Ohio	Track through center of stagnant HI
AUG 1	1155	1502	20	Columbus, Ohio Hartford,	Track in warm sector of large, low
5	0815	1009	21	Hartford, Conn. River	In a trough between two cold fronts
5	1105	1316	22	Long Is., N.J. (N.Y City Circle)	Same as above
5	1812	2027	23	Mass., Vt., Conn.	Cold front across track (weak)
6	0843	1438	24	Conn., N.Y., N.J. Coastal	Eastern side of large high

Table A2 WEATHER CONDITIONS PREVAILING DURING BATELLE FLIGHTS (Cont.)

Date 1975		Time (EDT) Start	End	Flight Number	Flight Area	Weather
AUG	9	1117	1213	25	Conn., N.Y., Long Is.	Low approaching cold front 270 mi west
	9	1214	1327	26	Long Is. to Conn.	Same as above, low sliding north
	9	1703	2002	27	NYC, over water S. Long Is.	Urban plume power plant North side of large HI
	10	1135	1737	28	Long Is., Conn.	Same as above
	10	1808	1900	29	Long Is., Conn.	South side of HI, front system 350 mi N
	11	1120	1128	30	Conn. (Abort)	Trough across track
	12	0948	1221	31	Conn., Mass.	Stationary front 180 mi N & NW--HI pressure
	13	1009	1250	32	N.Y., Mass., Conn.	North side of HI blocking frontal syste to N & NW
	13	1547	1837	33	Mass., Conn.	Just of trough extending up to low pressure system
	14	1005	1316	34	Mass., N.Y., Hudson River	Cold front line across track
	14	1515	1758	35	Mass., N.H.	Cold front just east of track
	15	0937	1347	36	NYC, Long Is., Coastal	SE edge of weak HI, low approach from west
	18	0920	0942	37	Mass., Conn. (Ms abort)	Cold front across track
	18	1207	1430	38	N.Y., Mass., Conn.	Cold front just east of track
	18	1632	2107	39	Over water S. of Cape Cod	Cold front across track
	19	1010	1201	40	Hartford, Toronto	SE edge of Large HI
	19	1640	1915	41	Toronto Westward	Same as above
	20	1030	1841	42	Toronto return	Eastern side of large HI
				43		Same as above
	21	0941	1148	44	Conn., Long Is.	Center of large high
	21	1408	1731	45	Conn., Long Is.	North side of high

Table A1 WEATHER CONDITIONS PREVAILING DURING EPA-LAS VEGAS FLIGHTS

Date 1975	Time (EDT) Start	Time (EDT) End	Flight Number	Flight Area	Weather
August 9	1500	1520	1	Circular around Boston	North side of large HI, cold front 200 mi N
10					
11	1210	1426	1	Around Boston and over water	Tracks in mod. trough, low to N
12	1020	1124	1	Circular, Boston	Track in weak low centered 210 mi to E
12	1308	1558	2	Square wave pattern E. Boston	Same as above
13	1008	1252	1	Circular Boston	North side of weak HI, low centered NW
13	1530	1716	2	Circular Boston	Same as above; squall line just W of track
14	1142	1256	1	Circular Boston	Cold front across track
14	1442	1742	2	Circular Boston, over water, S.	Cold front across track
15	1510	1742	1	Coastal, Cape	East side of weak HI
17	0850	1212	1	Loop, N. Boston	East side of complex low pressure system
19	0948	1307	1	Square wave pattern SE New England	East side of HI, cold front passed 15 hrs. before
19	1442	1706	2	Square wave pattern SE New England	Same as above; cold front 300 SE
20	0702	1214	1	Same as above	East side of large HI
20	1338	1612	2	Same as above	Same as above; westerly flow
26	0950	1224	1	Square wave pattern E. Boston	West side of HI, warm front 210 mi NW
26	1046	1726	1	N. Boston loop	Warm front approaching 80 mi W, HI SE
27	1028	1154	1	Circular Boston	Cold front passed 6 hrs. before, large HI W
27	1402	1536	2	Boston, NY, LI, coastal	Same as above, front 10 hrs. before
27	1536	1652	2	Return	Same as above
28	1050	1210	1	Boston, Maine, Coastal to Maine	Inside large HI centered 350 SE of track

Table A4 WEATHER CONDITIONS PREVAILING DURING INTERSTATE SANITATION COMMISSION (ISC) FLIGHTS

Date 1975	Time (EDT)		Flight Area	Weather
	Start	End		
August 10	0920	1221	Stratford-Freehold Conn., N.Y., N.J.	Track on north side of large high. Cold front 300 N
10	0950	1233	Trenton-Bivalve N.J.-Del., PA	Same as above
10	1410	1630	Stratford-Freehold	Same as above
10	1410	1635	Trenton-Bivalve	Same as above
11	1000	1227	Stratford-Freehold	Trough just W of track-possibly across it near end of flight
15	0845	0953	Trenton-Bivalve	N of cold front which passed 9 hr. before - S end of track possibly crossing it
15	1144	1703	Trenton-Bivalve	S side of weak hi, low moving in from W
15	1115	1551	Stratford-Freehold	Same as above
19	0939	1257	Trenton-Bivalve	SE end of hi behind cold front which passed 13 hr. before
19	1442	1800	Trenton-Bivalve	SE end of hi behind cold front which passed 20 hr. before
19	0923	1130	Stratford-Freehold	SE end of hi behind cold front which passed 18 hr. before
19	1340	1632	Stratford-Freehold	SE end of hi behind cold front which passed 22 hr. before
20	1000	1258	Trenton-Bivalve	SE end of high, cold front just S of track
20	1419	1710	Trenton-Bivalve	Same as above
20	1253	1607	Stratford-N.Y.	Same as above
21	1405	1700	Trenton-Bivalve	120 mi. N of cold front near center of high
21	0920	1201	Trenton-Bivalve	Same as above
21	0905	1200	Stratford-Freehold	Same as above
21	1345	1709	Stratford-Freehold	Same as above